The cumulative level of interference that is not to be exceeded in the wanted channel is -21 dB with respect to the reference sensitivity input level of Table 2.2. This corresponds to a BER equal to or better than 10^{-5} and is the basis of the W/U ratios used in the co-channel test of Table 2.2 of Part 2 (i.e. 21 dB) and in the adjacent channel test of Table 2.3 of Part 2 (i.e. -6 dB or -3 dB).

In practical situations interferers are likely to be at various levels at the receiver input port, point C of Fig 1.2, and practical receivers will provide a variety of filter protections.

3.11 The w/u ratios of Tables 4.3 and 4.4 for television and radar remoting systems assumes a single interferer at the quoted level.

3.12 The interference limits of Tables 4.3 and 4.4 are derived as follows:

$$Interference\ Limit = Reference\ Sensitivity\ Input\ Level\ (Table\ 2.2) - W/U$$

3.13 The adjacent channel limits given in Table 4.4 do not apply to links with correlated fading (such as links operating over the same hops).

Adjacent channel links operating over the same hop can be planned to equal free space (unfaded) levels.

3.14 *Planning requirements for partially correlated links are under study.*

Table 4.3: Single Entry Co-channel Interference Limits

Table 4.3 shows the single-entry co-channel interference limits at point C of Fig 1.2.

Type of Modulation	Capacity	W/U (dB)	Fig	Interference Limit
Digital	2 Mbit/s	27	2.3A	-135 dBW
	2 x 2 Mbit/s	27	2.3B	-132 dBW
	8 Mbit/s	27	2.3C	-129 dBW
	2 x 8 Mbit/s	27	2.3D	-129 dBW
	34 Mbit/s	24	2.3E	-123 dBW
	140/155 Mbit/s	24	2.3F	-117 dBW
Television with frequency modulation of the carrier	625 lines and video baseband up to 14 MHz	37	2.4B	-122 dBW
Radar remoting	Video baseband up to 14 MHz	38	2.4B	-122 dBW
Surveillance TV	Video baseband up to 3.5 MHz	28	2.4A	-126 dBW

Note: The interference limits of Tables 4.3 and 4.4 are derived as follows:

$$Interference\ Limit = Reference\ Sensitivity\ Input\ Level\ (Table\ 2.2) - W_I$$

Table 4.4 Single Entry Adjacent channel Interference limits.

Table 4.4 gives the adjacent channel interference limits for single-entry interference at point C of Fig 1.2.

Type of Modulation	Capacity	W/U (dB)	Assumed filter protection	Fig	Adjacent channel interference limit
Digital	2 Mbit/s	0	27 dB	2.3A	-108 dBW
	2 x 2 Mbit/s	0	24 dB	2.3B	-105 dBW
	8 Mbit/s	0	24 dB	2.3C	-102 dBW
	2 x 8 Mbit/s	0	24 dB	2.3D	-102 dBW
	34 Mbit/s	0	24 dB	2.3E	-99 dBW
	140/155 Mbit/s	0	24 dB	2.3F	-93 dBW
Television with frequency modulation of the carrier	625 lines and video baseband up to 14 MHz	0	37 dB	2.4B	-85 dBW
Radar remoting	Video baseband up to 14 MHz	0	38 dB	2.4B	-84 dBW
Surveillance TV	Video baseband up to 3.5 MHz	0	28 dB	2.4A	-98 dBW

4 DERIVATION OF RADIO FREQUENCY CHANNELS

4.1 The radio frequency channel arrangements are derived (according to CCIR Recommendation 1990-1994, Doc 9/31) using the formula:

$$f_p = (f_r + 3.5p) \text{ MHz}$$

where:

f_r = CCIR reference frequency of 25249 MHz
f_p = pattern frequency
p = pattern frequency number, $644 \leq p \leq 1214$

4.2 The radio frequency channel arrangement for carrier spacings of 112 MHz, 56 MHz, 28 MHz, 14 MHz 7 MHz and 3.5 MHz shown in Table 4.5 shall be derived as follows:

let f_o be the centre frequency of 28500.5 MHz = f_r + (929 x 3,5) MHz;
f_n be the centre frequency of a radio-frequency channel in the lower half of the band;
f'_n be the centre frequency of a radio-frequency channel in the upper half of the band;

then the centre frequencies of individual channels are expressed by the following relationships:

(a) For systems with a carrier spacing of 112 MHz
Lower half of band: $f_n = (f_o - 1008 + 112n)$ MHz
Upper half of band: $f'_n = (f_o + 112n)$ MHz
where:
$n = 1, 2, 3, \ldots 8$

(b) For systems with a carrier spacing of 56 MHz
Lower half of band: $f_n = (f_o - 980 + 56n)$ MHz
Upper half of band: $f'_n = (f_o + 28 + 56n)$ MHz
where:
$n = 1, 2, 3, \ldots\ldots 16$

(c) For systems with a carrier spacing of 28 MHz
Lower half of band: $f_n = (f_o - 966 + 28n)$ MHz
Upper half of band: $f'_n = (f_o + 42 + 28n)$ MHz
where:
$n = 1, 2, 3, \ldots\ldots 32$

(d) For systems with a carrier spacing of 14 MHz
Lower half of band: $f_n = (f_o - 959 + 14n)$ MHz
Upper half of band: $f'_n = (f_o + 49 + 14n)$ MHz
where:
$n = 1, 2, 3, \ldots\ldots 64$

(e) For systems with a carrier spacing of 7 MHz
Lower half of band: $f_n = (f_o - 955.5 + 7n)$ MHz
Upper half of band: $f'_n = (f_o + 52.5 + 7n)$ MHz
where:
$n = 1, 2, 3, \ldots\ldots 128$

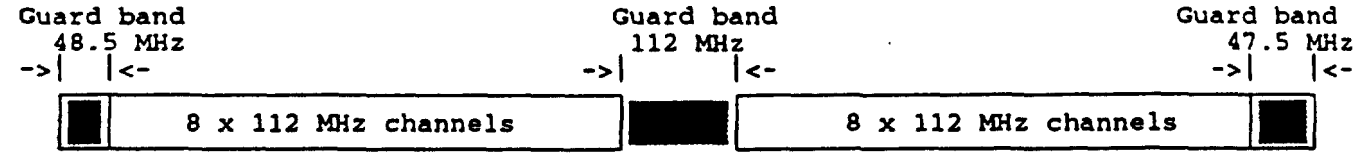
(f) For systems with a carrier spacing of 3.5 MHz
Lower half of band: $f_n = (f_o - 953.75 + 3.5n)$ MHz
Upper half of band: $f'_n = (f_o + 54.25 + 3.5n)$ MHz
where:
$n = 1, 2, 3, \ldots\ldots 256$

NOTES: 1. The centre and edge guard bands may be reduced at the discretion of the Radiocommunications Agency for the lower capacity systems by the addition of extra channels using frequencies derived from the homgeneous pattern of Section 4.1.

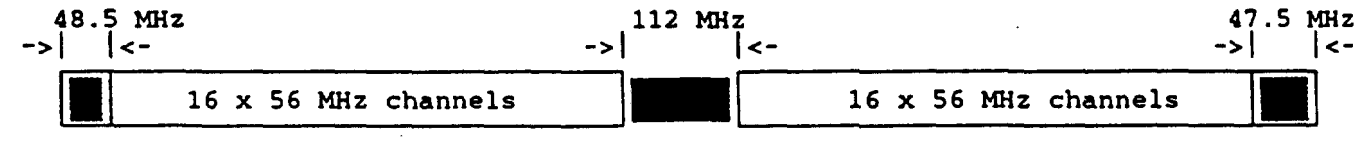
2. The radio frequency channel arrangements of a) to e) above use channel centre frequencies f_n and f'_n selected from the homogeneous pattern of Section 4.1. The arrangement f) above uses frequencies spaced by 3.5 MHz but interleaved between the homogeneous pattern of Section 4.1 with an offset of 1.75 MHz.

Table 4.6: Occupied spectrum

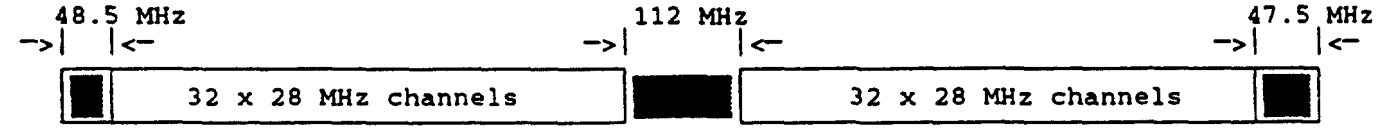
a) 112 MHz channels (3.5 MHz x 40)



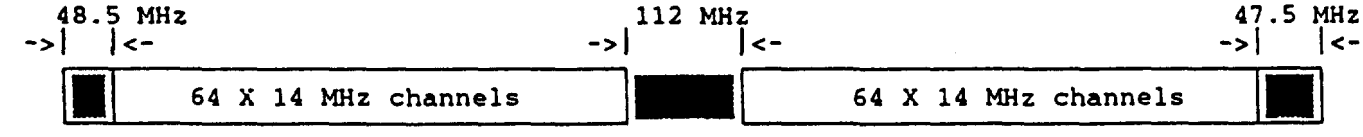
b) 56 MHz channels (3.5 MHz x 16)



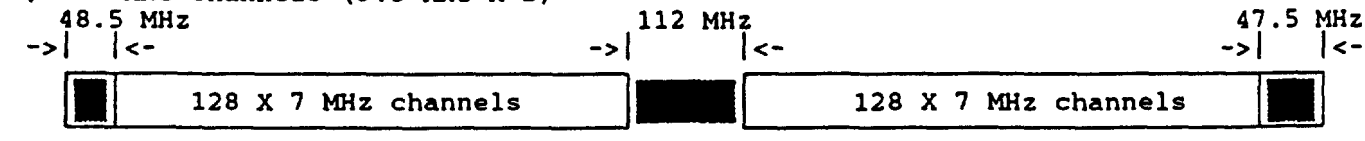
c) 28 MHz channels (3.5 MHz x 8)



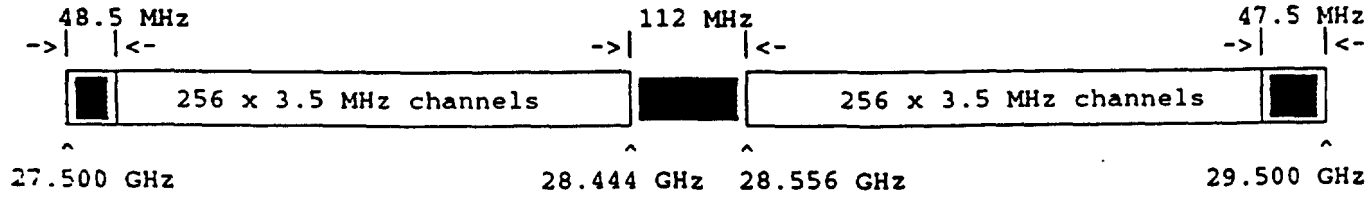
d) 14 MHz channels (3.5 MHz x 4)



e) 7 MHz channels (3.5 MHz x 2)



f) 3.5 MHz channels



FOR FIGS 4.2A - 4.2F

FADE MARGINS FOR VARIOUS AVAILABILITY TIMES, VERTICAL AND HORIZONTAL POLARISATIONS NEED TO BE DETERMINED.

EX PARTE PRESENTATION

INTERNATIONAL TELECOMMUNICATION UNION

RADIOCOMMUNICATION
STUDY GROUPS

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DRAFT REVISION OF RECOMMENDATION ITU-R F.748-1

RADIO-FREQUENCY CHANNEL ARRANGEMENTS FOR RADIO-RELAY SYSTEMS OPERATING IN THE 25, 26 AND 28 GHz BANDS

(Question ITU-R, 108/9)

(1992)

The ITU Radiocommunication Assembly,

considering

a) that the bands 24.25 - 25.25 GHz, 25.25 - 27.5 GHz and 27.5 - 29.5 GHz are allocated to fixed and other services;

b) that some administrations already use digital systems in one of these bands;

c) that the bands are used for differing applications by various administrations and that these applications require different frequency plans;

d) that several types of service with various capacities may be in simultaneous use in these frequency bands;

e) that the band allocated to each service or even to each administration may vary from one country to another;

f) that the applications in this frequency band may require differing channel bandwidths;

g) that a high degree of compatibility between different systems and between radio-frequency channels of different arrangements can be achieved by selecting all channel centre frequencies from a homogeneous basic pattern,

recommends

1 that the preferred radio-frequency channel arrangement for the 24.25 - 25.25 GHz, 25.25 - 27.5 GHz and 27.5 - 29.5 GHz bands should be based on homogeneous patterns;

2 that the homogeneous pattern with a preferred 3.5 MHz interval be defined by the relation:

$$f_p = f_r + 3.5\ p$$

where:

$1 \le p \le 285$ for the band 24.25 - 25.25 GHz

$287 \le p \le 928$ for the band 25.25 - 27.5 GHz

$930 \le p \le 1\ 500$ for the band 27.5 - 29.5 GHz

f_r: reference frequency of the homogeneous pattern;

3 that the homogeneous pattern with a preferred 2.5 MHz interval be defined by the relation:

$$f_p = f_r + 2 + 2.5\ p$$

where:

$1 \le p \le 399$ for the band 24.25 - 25.25 GHz

$401 \le p \le 1\ 299$ for the band 25.25 - 27.5 GHz

$1\ 301 \le p \le 2\ 099$ for the band 27.5 - 29.5 GHz

f_r: reference frequency of the homogeneous pattern;

4 that the reference frequency of the homogeneous pattern for international connections should be:

$$f_r = 24\ 248 \text{ MHz};$$

5 that all go channels should be in one half of any bidirectional band, and all return channels in the other;

6 that the channel spacings, XS, centre gap, YS, and the lower and upper band limits, Z_1S, Z_2S, should be agreed by the administrations concerned, dependent on the application and the channel capacity envisaged (see Recommendation ITU-R F.746 for definitions of XS, YS and ZS).

Note 1 - Due regard has to be taken that, in certain countries, a 3.5 MHz homogeneous pattern, interleaved by 1.75 MHz from that referred in **recommends** 2, is used in conjunction with the main pattern.

Note 2 - Examples of channel arrangements based on this Recommendation are described in Annexes 1, 2 and 3.

ANNEX 1

Radio-frequency channel arrangements for some CEPT administrations in the band 24.5 - 26.5 GHz in accordance with recommends 2

An example of the radio-frequency channel arrangement based on this Recommendation for carrier spacings of 112 MHz, 56 MHz, 28 MHz, 14 MHz, 7 MHz and 3.5 MHz is derived as follows (Fig. 1):

let f_0 be the reference frequency of 25 501 MHz = f_r + (358 x 3.5) MHz;

f_n be the centre frequency of a radio-frequency channel in the lower half of the band;

f'_n be the centre frequency of a radio-frequency channel in the upper half of the band;

then the centre frequencies of the individual channels are expressed by the following relationships:

a) for systems with a carrier spacing of 112 MHz
lower half of the band: $f_n = (f_0 - 1\,008 + 112\,n)$ MHz
upper half of the band: $f'_n = (f_0 + 112\,n)$ MHz

where n = 1, 2, 3, ... 8

b) for systems with a carrier spacing of 56 MHz
lower half of the band: $f_n = (f_0 - 980 + 56\,n)$ MHz
upper half of the band: $f'_n = (f_0 + 28 + 56\,n)$ MHz

where n = 1, 2, 3, ... 16

c) for systems with a carrier spacing of 28 MHz
lower half of the band: $f_n = (f_0 - 966 + 28\,n)$ MHz
upper half of the band: $f'_n = (f_0 + 42 + 28\,n)$ MHz

where n = 1, 2, 3, ... 32

d) for systems with a carrier spacing of 14 MHz
lower half of the band: $f_n = (f_0 - 959 + 14\,n)$ MHz
upper half of the band: $f'_n = (f_0 + 49 + 14\,n)$ MHz

where n = 1, 2, 3, ... 64

(see Note 1)

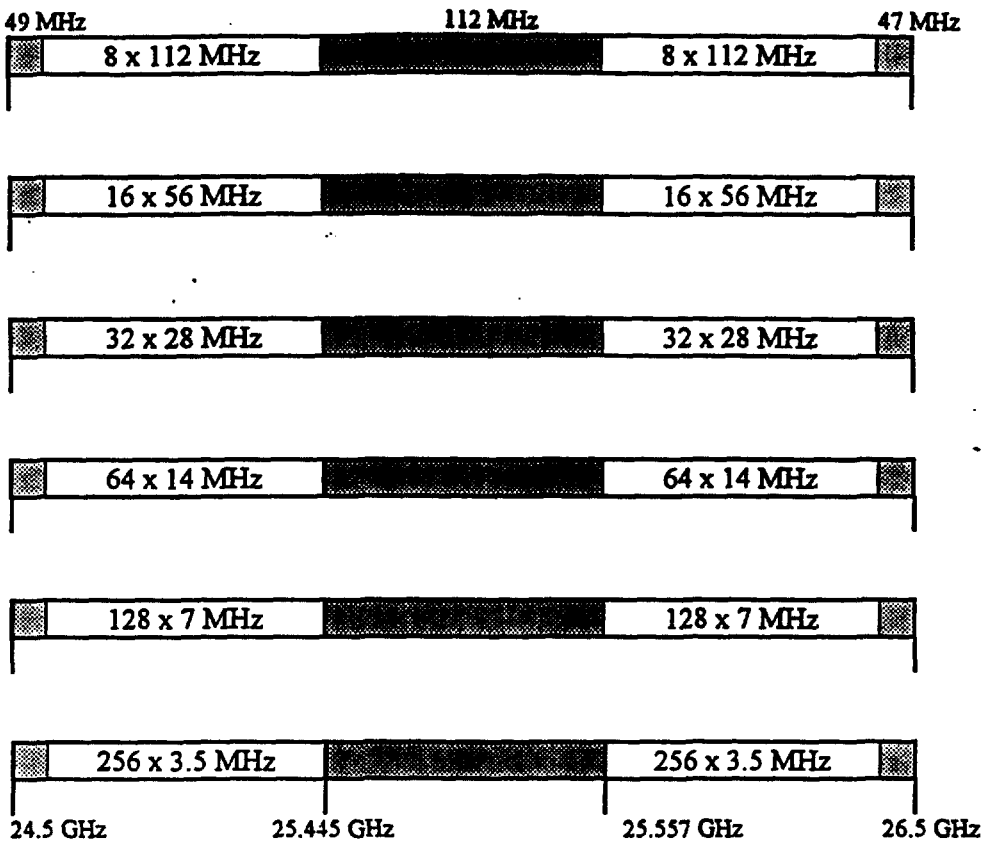
e) for systems with a carrier spacing of 7 MHz
lower half of the band: $f_n = (f_0 - 955.5 + 7\,n)$ MHz
upper half of the band: $f'_n = (f_0 + 52.5 + 7\,n)$ MHz

where n = 1, 2, 3, ... 128

f) for systems with a carrier spacing of 3.5 MHz
lower half of the band: $f_n = (f_0 - 953.75 + 3.5\,n)$ MHz
upper half of the band: $f'_n = (f_0 + 54.25 + 3.5\,n)$ MHz

where n = 1, 2, 3, ... 256

FIGURE 1



Note 1 - The radio-frequency channel arrangements of a) to e) above use channel centre frequencies f_n and f'_n selected from the homogenous pattern of **recommends** 2. The arrangement f) above uses frequencies spaced by 3.5 MHz but interleaved between the homogenous pattern of **recommends** 2 with an offset of 1.75 MHz.

Note 2 - Fig. 1 gives occupied spectrum in the 24.5 - 26.5 GHz band. The centre and edge guardbands may be reduced, by agreement between administrations, to allow the use of an increased number of lower capacity systems, by the addition of extra channels using frequencies derived from the homogenous pattern of **recommends** 2.

ANNEX 2

Radio-frequency channel arrangements for some CEPT administrations in the band 27.5 to 29.5 GHz in accordance with recommends 2

An example of the radio-frequency channel arrangement based on this Recommendation for carrier spacings of 112 MHz, 56 MHz, 28 MHz, 14 MHz, 7 MHz and 3.5 MHz is derived as follows:

let f_o be the reference frequency of 28 500.5 MHz = f_r + (1 215 x 3.5) MHz

f_n be the centre frequency of a radio-frequency channel in the lower half of the band;

f'_n be the centre frequency of a radio-frequency channel in the upper half of the band;

then the centre frequencies of the individual channels are expressed by the following relationships:

a) for systems with a carrier spacing of 112 MHz
lower half of the band: $f_n = (f_0 - 1\,008 + 112\,n)$ MHz
upper half of the band: $f'_n = (f_0 + 112\,n)$ MHz

where n = 1, 2, 3, ... 8

b) for systems with a carrier spacing of 56 MHz
lower half of the band: $f_n = (f_0 - 980 + 56\,n)$ MHz
upper half of the band: $f'_n = (f_0 + 28 + 56\,n)$ MHz

where n = 1, 2, 3, ... 16

c) for systems with a carrier spacing of 28 MHz
lower half of the band: $f_n = (f_0 - 966 + 28\,n)$ MHz
upper half of the band: $f'_n = (f_0 + 42 + 28\,n)$ MHz

where n = 1, 2, 3, ... 32

d) for systems with a carrier spacing of 14 MHz
lower half of the band: $f_n = (f_0 - 959 + 14\,n)$ MHz
upper half of the band: $f'_n = (f_0 + 49 + 14\,n)$ MHz

where n = 1, 2, 3, ... 64

e) for systems with a carrier spacing of 7 MHz
lower half of the band: $f_n = (f_0 - 955.5 + 7\,n)$ MHz
upper half of the band: $f'_n = (f_0 + 52.5 + 7\,n)$ MHz

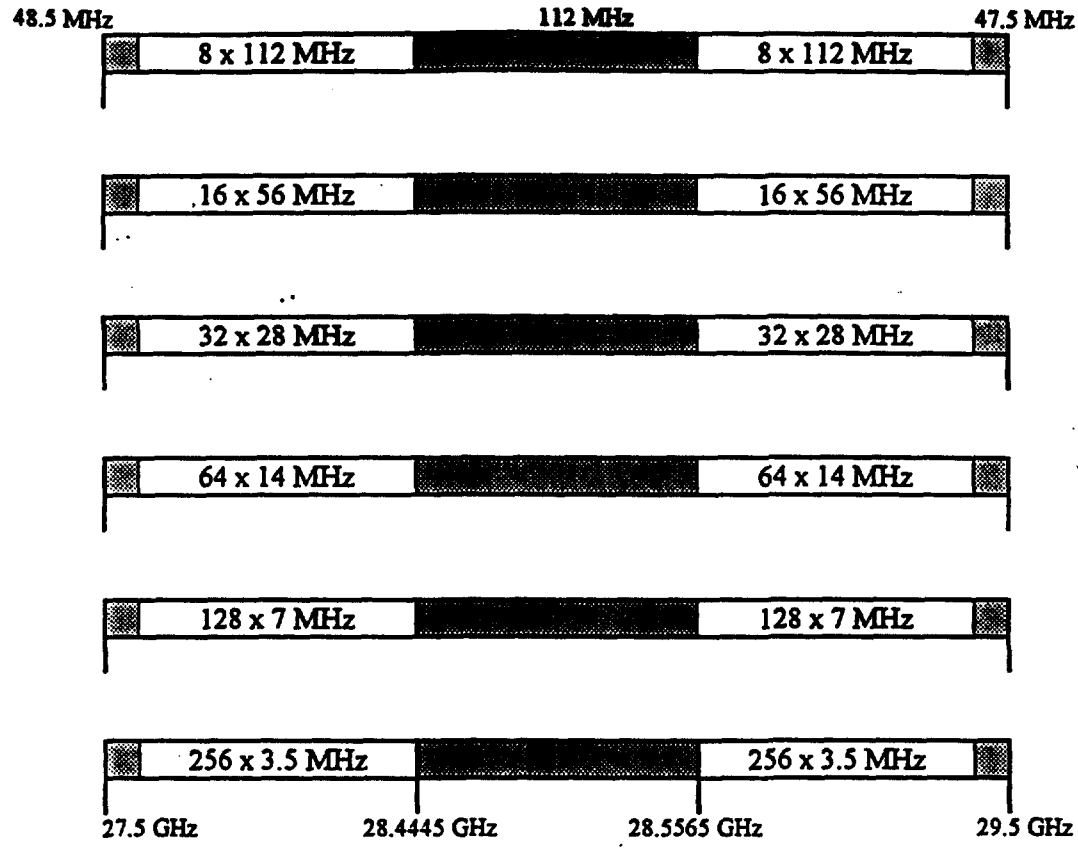
where n = 1, 2, 3, ... 128

(see Note 1)

f) for systems with a carrier spacing of 3.5 MHz
lower half of the band: $f_n = (f_0 - 953.75 + 3.5\,n)$ MHz
upper half of the band: $f'_n = (f_0 + 54.25 + 3.5\,n)$ MHz

where n = 1, 2, 3, ... 256

FIGURE 2



Note 1 - The radio-frequency channel arrangements of a) to e) above use channel centre frequencies f_n and f'_n selected from the homogenous pattern of **recommends** 2. The arrangement f) above uses frequencies spaced by 3.5 MHz but interleaved between the homogenous pattern of **recommends** 2 with an offset of 1.75 MHz.

Note 2 - Fig. 2 gives occupied spectrum in the 27.5 - 29.5 GHz band. The centre and edge guardbands may be reduced, by agreement between administrations, to allow the use of an increased number of lower capacity systems, by the addition of extra channels using frequencies derived from the homogenous pattern of **recommends** 2.

ANNEX 3

Radio-frequency channel arrangement in the band 25.25 - 27.5 GHz in accordance with recommends 2 (Germany)

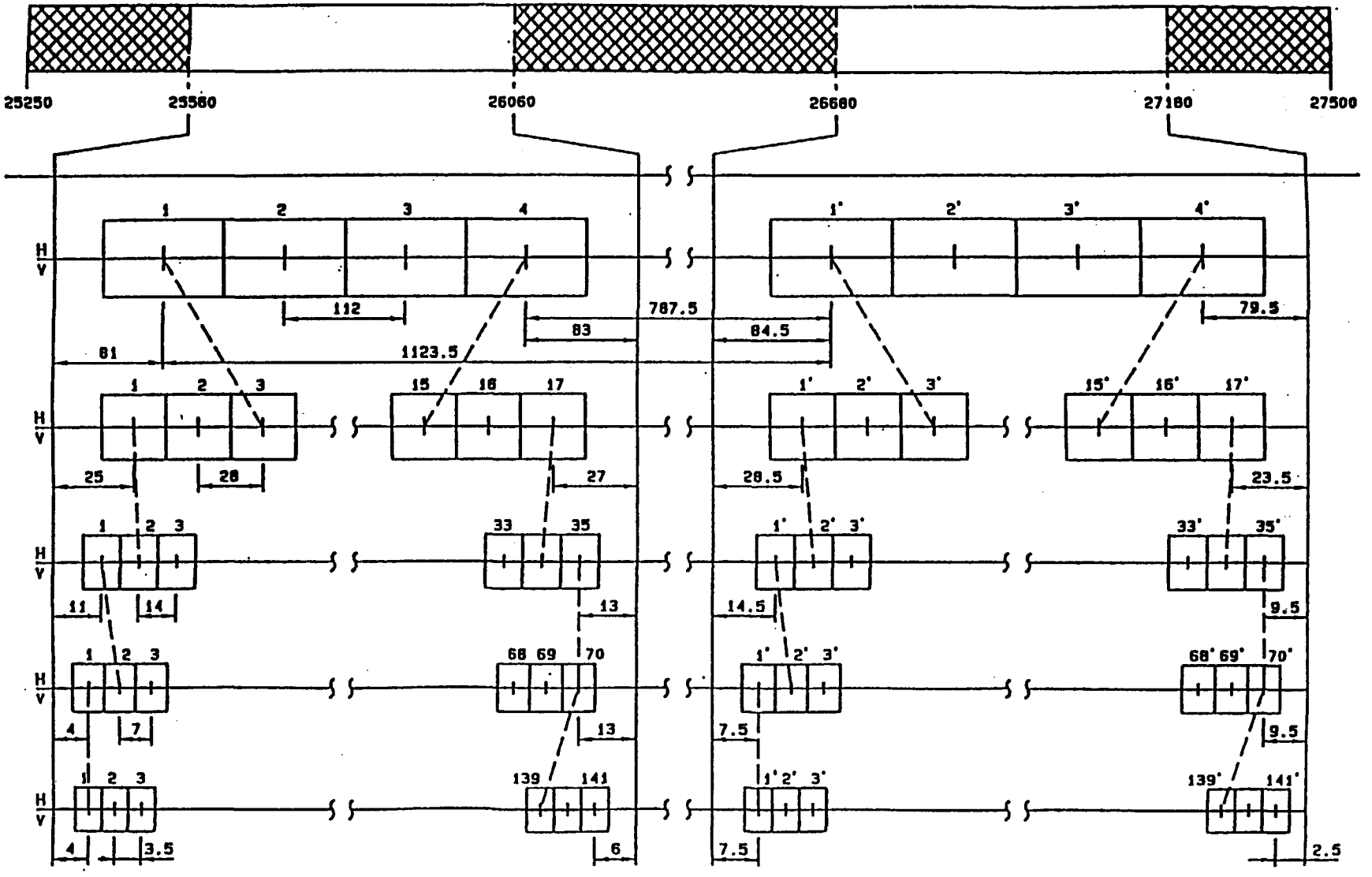
At present, in Germany, only the sub-bands 25.56 - 26.06 GHz and 26.68 - 27.18 GHz are available for realizing fixed-service links.

A duplex spacing has been chosen which enables easy extension of the channel arrangement to the complete band as allocated in the Radio Regulations, Article 8, without major changes within the existing network.

The channel arrangement is explained in detail in Fig. ~~1~~3.

FIGURE 43

Radio-frequency channel arrangements for digital radio-relay systems operating in parts of the band 25.25 - 27.5 GHz (Germany)



All frequencies are in MHz